EXHIBIT 4

BELLSOUTH TELECOMMUNICATIONS, INC.

DIRECT TESTIMONY OF W. KEITH MILNER

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 030137-TP

May 19, 2003

Q. PLEASE STATE YOUR NAME, YOUR BUSINESS ADDRESS, AND YOUR POSITION WITH BELLSOUTH TELECOMMUNICATIONS, INC. ("BELLSOUTH").

A. My name is W. Keith Milner. My business address is 675 West Peachtree Street, Atlanta, Georgia 30375. I am Assistant Vice President - Interconnection Operations for BellSouth. I have served in my present position since February 1996.

Q. PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.

A. My business career spans over 32 years and includes responsibilities in the areas of network planning, engineering, training, administration, and operations. I have held positions of responsibility with a local exchange telephone company, a long distance company, and a research and development company. I have extensive experience in all phases of telecommunications network planning, deployment, and operations in both the domestic and international arenas.

I graduated from Fayetteville Technical Institute in Fayetteville, North Carolina, in 1970, with an Associate of Applied Science in Business Administration degree. I obtained a Master of Business Administration degree from Georgia State University in 1992.

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE ANY STATE PUBLIC SERVICE COMMISSION?

A. I have previously testified before the state Public Service Commissions in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, and South Carolina, the Tennessee Regulatory Authority, and the North Carolina Utilities Commission on the issues of technical capabilities of the switching and facilities network regarding the introduction of new service offerings, expanded calling areas, unbundling, and network interconnection.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY TODAY?

A. In my testimony, I will address the technical aspects of network related issues that have been raised in this docket. Specifically, I will address the following issues, in whole or in part: Issues 8, 18, 20, 21, 23, 29, and 50.

Issue 8: <u>Universal or Integrated Digital Loop Carrier ("UDLC/IDLC") Technology</u>

(a) Should BellSouth be required to provide an unbundled loop using IDLC technology to DeltaCom which will allow Deltacom to provide consumers the same quality of service (i.e., no additional analog to digital conversions) as that offered by BellSouth to its customers? If so, under what rates, terms and conditions should it be provided?

Q. WHAT IS BELLSOUTH'S POSITION ON USING INTEGRATED DIGITAL LOOP CARRIER ("IDLC") TECHNOLOGY?

A. When an Alternative Local Exchange Carrier ("ALEC") such as Deltacom orders a voice grade unbundled loop from BellSouth, BellSouth provides a loop with technical characteristics suitable for voice grade services. Loops provided over IDLC are integrated into BellSouth's switch rather than being run through de-multiplexing equipment referred to as Central Office Terminals ("COTs"). Therefore, when an ALEC obtains a customer currently served by IDLC, it is necessary to provide a non-integrated facility (for example, a copper loop or a loop served by Universal Digital Loop Carrier ("UDLC")) to serve the customer. Because IDLC loops are integrated directly into the central office switch, BellSouth must take special measures to remove the switching functionality in order to provision the desired loop to the requesting ALEC. BellSouth has eight (8) alternatives for providing this non-integrated unbundled loop facility that are currently used by BellSouth when it is necessary to convert an

IDLC loop to an unbundled loop facility. All eight (8) alternatives provide unbundled loops suitable for voice grade services. If Deltacom wants a loop with particular transmission standards (that is, different from or higher than voice grade), Deltacom should order such a loop. If BellSouth is unable to offer a loop that meets Deltacom's requirements, Deltacom should place a New Business Request ("NBR") with BellSouth for the development of such a loop.

Q. PLEASE DESCRIBE THE ROLE OF DIGITAL LOOP CARRIER AS A MEANS OF PROVIDING CUSTOMER LOOPS.

A. In many cases, instead of using only simple copper facilities all the way to the customer's premises, other equipment is added to improve the transmission quality on very long loops, as well as minimize the overall cost of serving customers who are located a great distance from the central office ("CO"). Electrical signals deteriorate over distance and such deterioration, at some point, becomes noticeable to the customer as noise or low volume. Generally, the smaller the gauge of wire used for the pairs within the cable, the higher the resistance and thus, the greater the loss. One way to overcome these transmission problems is to use larger gauge cables when long loops are required and smaller gauge cables when shorter loops are required. Obviously, this would complicate both the process of designing and constructing loop facilities, as well as the inventorying, assignment, and activation processes used to actually provide service to a given customer.

Instead, standard gauge cables are used and equipment called "loop electronics" is added to compensate for long loops by digitizing the voice signals and adding any amplification required to ensure high quality service. In the context we are discussing, this digitization is referred to as the "analog to digital conversion." This digitization is important from a quality standpoint. Analog amplifiers have one significant disadvantage which digitization overcomes. The analog amplifier boosts a deteriorating signal; however, it also boosts the noise along with the signal (in this case, the voice). Digital amplifiers boost the signal, but also "clean up" the signal using various mathematical formulae such that the signal is returned to its original quality. The most common form of these "loop electronics" is equipment referred to as Digital Loop Carrier ("DLC"). The DLC equipment is housed in the same type of cabinet, which is placed at the junction of the loop feeder cable and the loop distribution cable.

The loop feeder cable (copper or fiber) is connected to the DLC equipment located at the junction of the loop feeder cable and loop distribution cable. Because this DLC equipment is located outside the CO, it is referred to as the Remote Terminal ("RT") equipment (i.e., it is located remotely from the CO). From the DLC RT equipment to the end user, BellSouth typically will use individual copper pairs to the customer's home or business. These copper pairs will terminate in the Network Interface Device ("NID") at the end user's premises. What is different about the use of DLC equipment is what occurs on the loop feeder part of the loop.

Q. PLEASE DISCUSS THE CONCENTRATION FUNCTION PERFORMED BY DLC EQUIPMENT.

A. The DLC unit (at the RT) performs a concentration function, whereby the feeder system provides fewer "talk-paths" (back to the CO) than there are distribution pairs. As an example, the DLC may concentrate 96 distribution pairs onto 48 feeder circuits. This would be referred to as having a concentration ratio of two to one (2:1) in that for every two loop distribution pairs to customers' premises, there is only one path to the CO over the loop feeder facilities. This means that not all 96 end users can receive dial-tone at the same time, so careful monitoring of service is essential to balance the number of distribution pairs to feeder "paths" dependent on the calling characteristics of the served customers. Generally, the higher the calling rate, the lower the concentration. While customers with very low calling rates might be concentrated at a ratio of 4:1, customers with very high calling rates might not be concentrated at all (that is, a ratio of one loop distribution pair to one loop feeder path for a ratio of 1:1).

Q. PLEASE DISCUSS THE MULTIPLEXING FUNCTION PERFORMED BY DLC EQUIPMENT.

A. The second function performed by the DLC equipment is called multiplexing. Multiplexing is a technique, which allows many individual customer lines (in the loop distribution portion) to share high capacity digital lines to the CO (in the loop feeder portion). For example, a common high capacity transmission system called the DS-1 allows 24 separate calls to share a single transmission facility. Each path or "channel" can carry a single conversation. Some simple mathematics shows that the 24 paths, each operating at 64 kilobits per second ("Kb/s"), would require a higher speed transmission facility of about 1.5 million bits per second (1.5 Mb/s). Thus, the basic functions provided by DLC equipment are digitization, concentration, and multiplexing. These functions are provided regardless of which style DLC equipment (integrated or non-integrated) is used.

Q. PLEASE DISCUSS THE DIFFERENCES BETWEEN INTEGRATED DIGITAL LOOP CARRIER AND NON-INTEGRATED OR "UNIVERSAL" DIGITAL LOOP CARRIER.

A. Essentially, there are two varieties of DLC. One form is often referred to as "universal" DLC. For this discussion, however, a more appropriate name is non-integrated DLC. The other form of DLC is referred to as "integrated DLC" or IDLC. A newer form of integrated DLC is referred to as Next Generation Digital Loop Carrier ("NGDLC").

The DLC equipment at the RT converts the voice signals from analog to digital through the process referred to as digitization. These digital signals are then sent to the CO over the loop feeder facilities. At the CO, non-integrated DLC equipment is terminated into equipment referred to as the COT. The COT takes the many signals carried by the single transmission facility and converts them back to individual signals (one per customer loop) for connection to the switching equipment within the CO. This process is referred to as de-multiplexing. Thus, from the COT, the individual loop circuits can be terminated onto the dial-tone providing switch within the CO, or they can be routed to some other location (e.g., collocation space, etc.). Within the BellSouth CO, loops served by non-integrated DLC may be connected directly to the BellSouth switch in that CO office (through the COT), or the loop may be extended into the ALEC's collocation space on an unbundled basis.

Q. PLEASE DISCUSS THE EQUIPMENT ARRANGEMENTS IN THE BELLSOUTH CENTRAL OFFICE FOR INTEGRATED DIGITAL LOOP CARRIER.

A. IDLC does not terminate in a COT. Instead, the IDLC terminates directly into the modern digital switch, which provides dial-tone and other switching functions to the customer.

Q. PLEASE DESCRIBE THE EIGHT (8) ALTERNATIVES FOR GIVING AN ALEC ACCESS TO LOOPS SERVED BY IDLC.

A. IDLC is a special version of DLC that does not require a host terminal in the central office, sometimes referred to as the COT, but instead terminates the digital transmission facilities directly into the central office switch. In its Texas Decision, the Federal Communications Commission ("FCC") found that "the BOC must provide competitors with access to unbundled loops regardless of whether the BOC uses integrated digital loop carrier (IDLC) technology or similar remote concentration devices for the particular loops sought by the competitor." Memorandum Opinion and Order, *Application by SBC Communications Inc., et al., Pursuant to Section 271 of Telecommunications Act of 1996 to Provide In-Region, InterLATA Services in Texas*, 15 FCC Rcd 18354, ¶ 248 (2000) ("*Texas Order*"). BellSouth provides access to such IDLC loops via the following methods:

- Alternative 1: If sufficient physical copper pairs are available, BellSouth will reassign the loop from the IDLC system to a physical copper pair.
- Alternative 2: Where the loops are served by NGDLC systems, BellSouth will "groom" the integrated loops to form a virtual Remote Terminal RT arranged for universal service (that is, a terminal which can accommodate both switched and private line circuits). "Grooming" is the process of arranging certain loops (in the input stage of the NGDLC) in such a way that discrete groups of multiplexed loops may be assigned to transmission facilities (in the output stage of the NGDLC). Both of the

NGDLC systems currently approved for use in BellSouth's network have "grooming" capabilities.

- Alternative 3: BellSouth will remove the loop distribution pair from the IDLC and re-terminate the pair to either a spare metallic loop feeder pair (copper pair) or to spare universal digital loop carrier equipment in the loop feeder route or Carrier Serving Area ("CSA"). For two-wire ISDN loops, the universal digital loop carrier facilities will be made available through the use of Conklin BRITEmux or Fitel-PMX 8uMux equipment.
- Alternative 4: BellSouth will remove the loop distribution pair from the IDLC and re-terminate the pair to utilize spare capacity of existing Integrated Network Access ("INA") systems or other existing IDLC that terminates on Digital Cross-connect System ("DCS") equipment. BellSouth will thereby route the requested unbundled loop channel to a channel bank where it can be de-multiplexed for delivery to the requesting ALEC or for termination in a DLC channel bank in the central office for concentration and subsequent delivery to the requesting ALEC.
- Alternative 5: When IDLC terminates at a switch peripheral that is capable of serving "side-door/hairpin" capabilities, BellSouth will utilize this switch functionality. The loop will remain terminated directly into the switch while the "side-door/hairpin" capabilities allow the loop to be provided individually to the requesting ALEC.
- Alternative 6: If a given IDLC system is not served by a switch

peripheral that is capable of side-door/hairpin functionality, BellSouth will move the IDLC system to switch peripheral equipment that is side-door capable.

- Alternative 7: BellSouth will install and activate new UDLC facilities or NGDLC facilities and then move the requested loop from the IDLC to these new facilities. In the case of UDLC, if growth will trigger activation of additional capacity within two years, BellSouth will activate new UDLC capacity to the distribution area. In the case of NGDLC, if channel banks are available for growth in the CSA, BellSouth will activate NGDLC unless the DLC enclosure is a cabinet already wired for older vintage DLC systems.
- Alternative 8: When it is expected that growth will not create the need for additional capacity within the next two years, BellSouth will convert some existing IDLC capacity to UDLC.

The sufficiency of these eight (8) alternatives was an issue in BellSouth's Section 271 proceedings before the nine State Commissions in BellSouth's region as well as the Section 271 proceedings before the Federal Communications Commission ("FCC") as BellSouth sought in-region interLATA long distance authority. All nine states and the FCC affirmed that BellSouth provides unbundled loops to ALECs on a nondiscriminatory basis, including those loops served by IDLC equipment. The Florida Public Service Commission made such a finding in Docket No. 960786-TL.

The eight (8) alternatives for giving an ALEC access to loops served by IDLC listed above are listed in order of complexity, time, and cost to implement. The simplest is listed first and the most complex, lengthy, and costly to implement listed last. Also, Alternative 1 and the copper loop solution of Alternative 3 do not add additional Analog to Digital conversions; which would appear to alleviate Deltacom's primary concern. When an ALEC orders a loop, BellSouth delivers that loop to the specifications ordered by the ALEC. Thus, ordinarily BellSouth chooses the method for delivering the loop meeting the ordered specification without involving the ALEC. BellSouth does not ordinarily consult the ALEC as to which alternative will be used in a given instance. If, however, BellSouth concludes that only Alternatives 7 or 8 can give the ALEC a loop meeting the specifications it ordered and because the application of these Alternatives may require the requesting ALEC to pay special construction charges, BellSouth would proceed with implementation only if the ALEC agrees.

Q. HAS THERE BEEN ANY EFFORT ON BEHALF OF BELLSOUTH AND DELTACOM TO ADDRESS ATTEMPTS TO MINIMIZE OR ELIMINATE THE NEED FOR ADDITIONAL ANALOG TO DIGITAL CONVERSIONS?

A. Yes. BellSouth agreed to work cooperatively with Deltacom to explore some technical possibilities in an attempt to minimize or eliminate the need for additional Analog to Digital conversions. Unfortunately, those efforts were unsuccessful owing to no shortcoming on either BellSouth's or Deltacom's part. To my knowledge, there simply is no technically feasible way to accomplish what Deltacom is asking. Further, Deltacom has proposed no technical alternative beyond those that have already been tested.

BellSouth provides Deltacom with unbundled loops (whether on so-called UDLC or other technology) that meet the technical transmission requirements for voice grade loops. If Deltacom wishes a loop with different or more stringent technical characteristics than the loops BellSouth currently offers, Deltacom should request such a loop via the New Business Request process.

Q. PLEASE BRIEFLY DESCRIBE THE GOALS OF THE IDLC TECHNICAL TRIAL THAT BELLSOUTH CONDUCTED.

A. On January 13, 2003, BellSouth met with Deltacom in Anniston, Alabama to discuss the benefits and goals of BellSouth engaging in a technical trial of some technical alternatives that, if successful, might be useful in addressing Deltacom's concerns regarding analog to digital conversions that are inherent when loops are provided over certain technology. Several other conference calls between BellSouth's and Deltacom's technical experts ensued. In a spirit of cooperation, BellSouth agreed to shoulder the expense of this trial even though ordinarily an ALEC would detail the type loop it desired and, if that loop type is not currently offered, use the New Business Request process to have BellSouth analyze the feasibility of such a development. Mr. Gary Tennyson, a Director in BellSouth's Science and Technology organization, was chosen to coordinate the trial and Mr. Tennyson marshalled appropriate resources within BellSouth to conduct the technical trial and to document the findings of that trial. Essentially, the trial was meant to determine if loops provided over IDLC could be provisioned without any additional analog to digital conversions (compared to the quantity of analog to digital conversions when the end user was a BellSouth retail customer) using functionality referred to as "side door" or "hair pin" arrangements within the BellSouth switch and additional equipment referred to as Digital Cross-connect System ("DCS") to aggregate unbundled loops for a given ALEC. For the trial, Deltacom furnished a list of telephone numbers of 'friendly customers' who had BellSouth service. From this list, two (2) lines were selected. These customers were served via a Nortel DMS100 office in BellSouth's network, and DCS equipment was already installed in that building.

DMS100 switch peripheral (SMS) assignments were obtained for the loops in question. The availability of vacant DS1 terminations on the associated SMS was verified. DS1 terminations in the DCS were obtained, and BellSouth built circuits from the DCS to the SMS's. The DS1 facilities between Deltacom's collocation arrangement and the DCS were also built.

Q. WHAT WAS THE OUTCOME OF THE TECHNICAL TRIAL?

A. The trial was unsuccessful. Unfortunately, two (2) unforeseen issues arose. It turns out that the loops to be converted were working in Mode II, i.e., concentrated mode. Concentration, in this setting, is the sharing of transmission paths between the DLC Remote Terminal and the switch. For example, two (2) end users might share a single path and this is referred to as 2:1 concentration. In the DMS100 switch, a Mode II channel must be in the four (4) right-most line card slots, i.e., channels 17-24, of the digital transmission facility in order to be 'hairpinned' in the switch.

BellSouth also learned during the trial that only one (1) customer may be assigned to the Remote Terminal card (which normally accommodates two lines) serving the loop to be unbundled. This limitation arises due to the fact that the DMS100 'nails up' both channels on the line card. Because it's extremely unlikely that both end-users would be converting simultaneously to the same ALEC, this effectively means that the other channel must be vacant, resulting in stranded investment. To overcome these limitations, the end-users to be converted would have to be re-assigned to other DLC cards or other facilities. This would involve, among other things, a transfer at the crossbox.

Q. WHAT DOCUMENTATION OF THE TECHNICAL TRIAL DID

BELLSOUTH PROVIDE TO DELTACOM?

A. The best description of the trial outcomes is documented in the "white paper" that Mr. Tennyson produced at the end of the trial. A copy of that "white paper" was furnished to Deltacom at the end of the trial and a copy is attached to my testimony as Exhibit WKM-1. BellSouth and Deltacom had discussed before the trial began that, even if successful, providing loops via DCS equipment might be prohibitively expensive for both parties. Anticipated costs included the following:

- Determining the availability of spare switch peripheral ports,
- Determining the availability of a Digital Cross-connect System and spare ports
- The provisioning of DS1 links between the switch peripherals and the Digital Cross-connect ports
- The use of the Digital Cross-connect system

When the unanticipated cost of the line rearrangements (necessary to 'hairpin' a mode II IDLC channel in a DMS100 office) became known, the process was viewed to be even less viable. No effort was made to transfer the end-users or continue the trial. Finally, when BellSouth better understood the effect of multiple links of robbed-bit signaling on V.90 modem performance, there was simply no point in continuing the work. BellSouth removed the temporary arrangements it had made and informed Deltacom, in a conference call of both parties' technical subject matter experts participating, that the trial was unsuccessful.

Q. HAS DELTACOM RESPONDED FORMALLY TO BELLSOUTH'S "WHITE PAPER" DISCUSSING THE OUTCOME OF THE TECHNICAL TRIAL?

A. No. I was on the conference call I mentioned earlier and I believe Deltacom's representative appreciated the candor with which BellSouth explained its findings. From BellSouth's viewpoint, I believe the technical trial demonstrates that the technical solutions attempted are not technically feasible. At the conclusion of the conference call, BellSouth invited Deltacom to suggest other technical solutions but so far, Deltacom has made no such suggestion. To summarize, it is my belief that BellSouth and Deltacom worked together in good faith to solve a technical problem for which at present there is no technically feasible solution.

Issue 18: <u>Testing of NXXs, Call Forwarding Variable and Remote Access to Call Forwarding Variable</u>

(a) Should DeltaCom be allowed to use call forwarding, call forwarding variable, and remote access to call forwarding variable for testing whether NXXs are being correctly translated in the Bellsouth network?

(b) If so, what rates should apply?

Q. WHAT IS BELLSOUTH'S POSITION ON THIS ISSUE?

Overview

This paper documents the lessons learned in a trial with ITC/DeltaCom. The trial attempted to unbundle a loop delivered via Integrated Digital Loop Carrier (IDLC) without incurring an additional Analog to Digital conversion. The trial was not successful.

Analog to Digital Conversions

Analog to Digital (A/D) conversions occur at analog interfaces to digital transport and digital switching. The latest dial-up modem protocol (as documented in ITU Recommendations V.90 and V.92) requires that there be only one A/D conversion, between the server modem pool (usually designated as a Remote Access Server) and the end-user. In the case of a digital switch serving metallic loops, with a digital trunk to a RAS, there is one A/D conversion in the line interface card in the digital switch. The V.90 protocol can be supported.

In the case of a digital switch serving Universal Digital Loop Carrier (UDLC), there is another A/D conversion in the channel unit at the DLC Remote Terminal (RT). The V.90 protocol cannot be accommodated, and the modems 'fall back' to the previous generation protocol, documented in ITU Recommendation V.34.

When IDLC to an ILEC switch is employed, there is no A/D conversion at the switch. The V.90 protocol can be supported.

Conversion to a UNE Loop

All three loop-types described above, i.e., metallic, UDLC, and IDLC, can be unbundled. Conversion of a metallic loop is straightforward. The A/D conversion point moves to the CLEC. Similarly, when a UDLC loop is unbundled, there are no additional A/D conversions. There were two A/D conversions when the end-user was served by the ILEC and there are two conversions when the end-user is served by the CLEC.

It is when the end-user is served via IDLC that the problem gets interesting. In different places, we have documented the various alternatives that are available when making such a conversion. They are as follows:

- Transfer the loop to copper feeder, if available
- Transfer the loop to a UDLC channel, if available
- Route the T1 lines serving the IDLC through a Digital Cross-Connect System. Subsequently, digitally cross-connect the channel to either a UDLC COT or a DS1 interface to the CLEC
- Use the switch-based 'hairpin' capability to route the channel back out of the switch, for connection to either a UDLC COT or a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC
- Convert the IDLC system to UDLC

If the IDLC system is an NGDLC system, it is — at least theoretically — possible to use the time-slot interchanger to connect the channel to either a UDLC COT, or a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC. We do not, however, have the OAM&P systems in place to utilize this capability.

Note that some of these alternatives add an A/D Conversion. Those alternatives that do not add an A/D conversion are as follows:

- Transfer the loop to copper feeder, if available
- Route the T1 lines serving the IDLC through a Digital Cross-Connect System. Subsequently, digitally cross-connect the channel to either a DS1 interface to the CLEC
- Use the switch-based 'hairpin' capability to route the channel back out of the switch, for connection to a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC

Multiple Robbed-Bit Signaling Links

The fact that the V.90 protocol cannot be supported across multiple A/D conversions is well known in the industry. It's less well known, though, that the presence of only 1 A/D conversion does not — in itself — guarantee that the V.90 protocol can be supported. Another limiting factor is multiple links of robbed-bit signaling.

DLC systems employ robbed-bit signaling, where the least-significant bit of the 8 bit encoded sample is overwritten with signaling information every 6^{th} frame. The V.90 protocol is designed to recognize the robbed bit every 6^{th} frame, so this isn't a problem with IDLC (into an ILEC switch).

When a DS0 with robbed-bit signaling traverses multiple DS1 links without intermediate conversions to analog, using a Digital Cross-Connect System (DCS) for instance, it's necessary that the signaling bits be written to multiple frames. This is necessary because the DS1's are not aligned on these six-frame groups (denoted superframes), or even frames, for that matter). The 6^{th} frame in the first link, for instance, may be the 3^{rd} frame in the next link. To overcome this problem, the product connecting the links (the DCS, to use the above example) must find the incoming superframe boundaries, detect the incoming signaling state, find the outgoing superframe boundaries, and repeat the signaling bits. It can be seen that 5/6 of the time, this will involve overwriting of a bit that was valid data.

As one might expect, multiple links of robbed-bit signaling impair the performance of V.90 modems. *This is a very important point that wasn't fully appreciated at the onset of the trial.* This problem is described in more detail in Annex A of ANSI T1.403.02a-2001, **Network and Customer Installation Interfaces — DS1 Robbed-bit Signaling State Definitions**. While the problem is well documented in the reference, the impact, i.e., that percentage of modems that can run V.90 across a specific number of robbed-bit links, isn't documented in the public domain. Discussions with vendors, though, indicate that most V.90 modems cannot employ the V.90 protocol when exposed to 3 such links. They 'fall back' to the V.34 protocol at 33.6 kbps or less.

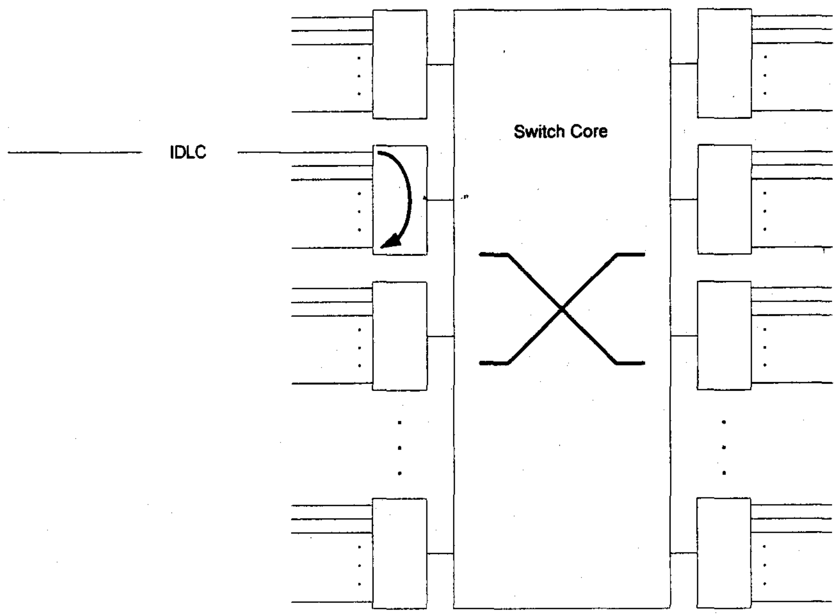
ITC/DeltaCom

ITC/DeltaCom initiated discussions with BellSouth regarding the unbundling of IDLC loops without incurring additional A/D conversions. After initial discussions, a decision was made to conduct a trial.

Although both parties recognized that the alternative of transferring a loop to copper feeder (if the copper is available) was a means of unbundling a loop without incurring an additional A/D conversion, such a conversion was not part of the trial. Early in the discussion, ITC/DeltaCom indicated that they has tried such conversions in the past, and had experienced various voicegrade transmission impairments. This avenue was not further pursued.

The second alternative, i.e., grooming of IDLC Channels in a Digital Cross-Connect System (DCS) was discussed. This alternative has a number of shortcomings. For one thing, a DCS not available in all CO's. For another, the DS1 circuits serving the DLC system must be routed through the DCS. This activity has a long lead time, and cannot be accommodated on a service-order basis. There is also a significant cost associated with the required DCS ports, and the associated maintenance activity. It should also be noted that any service outages during these rearrangements would affect all users served by the DLC system, not just those users converting to the CLEC. For these reasons, this alternative was not pursued.

The remaining alternative, i.e., using the switch-based 'hairpin' capability was the focus of the trial. We recognized at that time that, in a DMS100, the 'nail-up' could only be made within the switch peripheral, as illustrated in Figure 1, below:



DMS-100
Nail-Up only in Peripheral

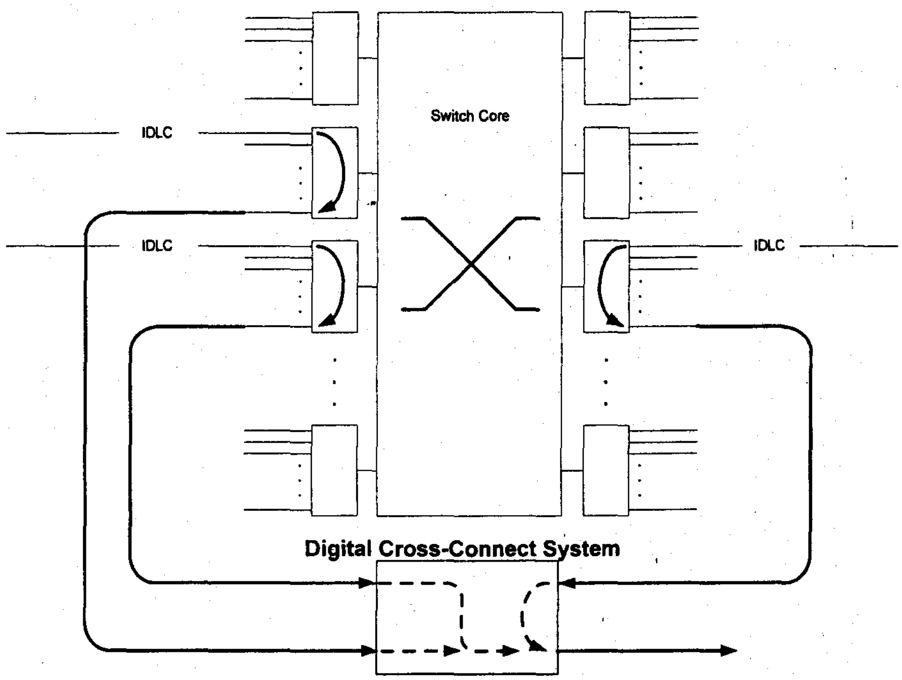
Figure 1

We also recognized that lines served via GR-303 IDLC and via Nortel DMS-1 Urban could not be 'nailed-up.'

We thought that the 5ESS and the EWSD did not suffer from the first limitation. The documentation on those switches suggested that they offered the ability to 'nail-up' a connection across an office, i.e., from one peripheral to another. Subsequent testing in the BellSouth technology Assessment Center proved that not to be the case. Only connections within the same switch peripheral can be 'nailed-up.'

The issue of multiple links of robbed-bit signaling (arising from chaining together these DS1's), and its effect on V.90 performance, was not discussed.

We recognized other limitations. We knew, for instance, that there are a limited number of ports per peripheral. We also recognized that this arrangement would have a very low DS1 fill unless a DCS were added, as illustrated in Figure 2, below.



Aggregation via DCS

Figure 2

For the trial, ITC/DeltaCom furnished a list of telephone numbers of 'friendly customers' who has BST service. From this list, two lines were selected. These customers were served via a DMS100 office, and a DCS was in the building.

DMS100 switch peripheral (SMS) assignments were obtained for the loops in question. The availability of vacant DS1 terminations on the associated SMS was verified. DS1 terminations in the DCS were obtained, and circuits were built from the DCS to the SMS's. The DS1 between DeltaCom's collocation and the DCS was also built.

Lessons Learned

Unfortunately, two unforeseen issues arose. It turns out that the loops to be converted were working in Mode II, i.e., concentrated mode. In the DMS100 switch, a Mode II channel must be in the four right-most slots, i.e., channels 17-24, of a digroup in order to be 'hairpinned' [1].

We also found that only one customer may be assigned to the RT card (which normally accommodates two lines) serving the loop to be unbundled. This limitation arises due to the fact that the DMS100 'nails up' both channels on the card. Because it's extremely unlikely that both end-users would be converting simultaneously to the same CLEC, this effectively means that the other channel must be vacant.

To overcome these limitations, the end-users to be converted would have to be re-assigned. This would involve, among other things, a transfer at the crossbox.

Conclusion

We recognized, going into this trial, that it would be expensive. Anticipated costs included the following:

- Determining the availability of spare switch peripheral ports,
- Determining the availability of a Digital Cross-Connect System and spare ports
- The provisioning of DS1 links between the switch peripherals and the Digital Cross-Connect ports
- The use of the Digital Cross-Connect system

When the unanticipated cost of the line rearrangements (necessary to 'hairpin' a mode II IDLC channel in a DMS100 office) became known, the process was viewed to be even less viable. No effort was made to transfer the end-users or continue the trial.

When we better understood the effect of concatenated links of robbed-bit signaling on V.90 modem performance, there was simply no point in continuing the work.

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[1] These slots were the only ones available for services requiring full-period assignment, i.e., coin and special services, in a SLC-96 system. A Series 5 system has no such slot restrictions, but it appears that the DMS100 retains the limitation even with the Series 5.